

SSVEO IFA List

Date:02/27/2003

STS - 48, OV - 103, Discovery (13)

Time:04:16:PM

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: Prelaunch	Problem	FIAR	IFA STS-48-V-01 ECLSS
EECOM-01	GMT: Prelaunch		SPR 48RF01	UA
			IPR	PR ECL-3-A0039
				Manager:
				Engineer:

Title: Avionics Bay 1 Smoke Detector B False Alarms (ORB)

Summary: DISCUSSION: At 255:12:54:40 G.m.t. (approximately 11 hours prior to launch), smoke detector B in avionics bay 1 annunciated a master caution and warning (C&W) alarm which was determined to be false. A data review of the smoke detector alarm event showed that the indicator remained on for a period of 4 seconds and then switched off. Approximately 50 seconds later, the same indicator came on again for 2 seconds. During the alarm period, no increases in smoke concentration or decreases in input voltage were noted. Further data review of this anomaly showed that at least three other occurrences of alarm event indicators had occurred on this smoke detector. However, no alarms were activated because of these three events. To minimize any erroneous nuisance smoke detector alarms during the flight, a decision was made to open the circuit breaker before lift-off, then close it again on-orbit, and open it again for each sleep period.

On-orbit, at 257:20:26:24 G.m.t., an additional false smoke alarm occurred on the same smoke detector. The circuit breaker was then opened by the crew for the remainder of the mission to preclude any further nuisance alarms. Intermittent alarm-event indicators have been noted on many previous missions. The majority of these previous event-indicator occurrences have not been of either sufficient duration or output voltage amplitude to annunciate C&W alarms. Smoke detector A in avionics bay 3 did experience event indicator occurrences of sufficient duration to annunciated the C&W alarm on STS-32. This smoke detector was removed and replaced, however, it was damaged before failure analysis could be performed. CONCLUSION: The cause of the false alarms is presently unknown. A detailed failure analysis is underway on the removed STS-48 smoke detector. CORRECTIVE_ACTION: Smoke detector B in avionics bay 1 on OV-103 has been removed and replaced. The removed unit is undergoing failure analysis at the vendor. The replaced unit will be verified per OMRSD retest requirements prior to the next flight. Even if this problem should recur, redundant smoke detection capability exists in the Orbiter. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 000:00:21	Problem	FIAR	IFA STS-48-V-02 EPD&C,MECH

MMACS-01

GMT: 255:23:33

SPR 48RF02

UA

Manager:

IPR

PR OEL-00135

Engineer:

Title: ET Door Centerline Latch 1 Motor 2 Phase B Failure (ORB)

Summary: DISCUSSION: During the External Tank (ET) umbilical door closing activities, the centerline latch-1 drive-motor 2 showed no operation on Phase B. Since the loss of a single phase on a motor does not significantly affect power drive unit (PDU) startup or operation, the centerline latch was stowed in dual-motor time, and there was no impact on the mission.

CONCLUSION: Troubleshooting was able to recreate the failure seen during flight and isolate its source to the aft motor control assembly 2 (AMCA 2). The most probable cause of the problem is a single-contact relay failure within AMCA 2. CORRECTIVE_ACTION: The AMCA 2 has been removed and replaced and returned to Rockwell/Downey for failure analysis and repair. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. A spare AMCA 2 was available on site.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 001:01:02	Problem	FIAR	IFA STS-48-V-03
EGIL-01	GMT: 257:00:14		SPR 48RF03	PRSD,FCP
			IPR 42V-0004	Manager:
				Engineer:

Title: Fuel Cell 1 O2 Reactant Valve False Close Indication (ORB)

Summary: DISCUSSION: The position indication of the fuel cell 1 oxygen (O2) reactant valve changed from open to closed (V45X1150E) at 257:00:14 G.m.t. This generated a "S69 FC REAC" caution and warning message and caused a talkback on panel R1 to read "CL". The crew tied main bus A and main bus B together per procedures and attempted to reopen the reactant valve with a panel switch, but the valve status did not change. Continued satisfactory operation of the fuel cell would have shut down in a maximum of 6 minutes had the reactant valve actually been closed.

Thirty-three hours after the reactant valve indication changed to closed, the indication changed to the open status. This change occurred simultaneously with the crew-commanded physical closure of the O2 manifold 1 isolation valve. Since the reactant valve and the manifold isolation valve share a common mounting on a valve panel structure, this suggests that the mechanical shock from operating the manifold valve "repaired" the open in the electrical circuit that caused the valve close indication. An open in the measurement circuit causes a valve close indication. The reactant valve indication was proper for the remainder of the flight. Since operating the manifold valve corrected the reactant valve close indication, it is suspected that the valve connector experienced an open condition, or the reed switch inside the valve malfunctioned. Postflight troubleshooting was unable to duplicate or determine the cause of the false indication. CONCLUSION: The false fuel cell 1 O2 reactant valve close indication

was most probably cause by a temporarily open condition in the valve status indicator circuit. **CORRECTIVE_ACTION:** None. The valve will be removed and replaced during the Orbiter maintenance down period following the next flight of OV-103 (STS-42). **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None. The presence of a false reactant valve closed indication does not affect fuel cell operation. The launch commit criteria protects against launching with a similar condition.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 003:11:58	Problem	FIAR	IFA STS-48-V-04
EECOM-04	GMT: 259:11:10		SPR 48RF04	UA
			IPR	PR UA-3-A0019
				Manager:
				Engineer:

Title: Supply Water Dump Valve Leakage (ORB)

Summary: DISCUSSION: At approximately 259:11:04 G.m.t., as the supply water dump nozzle was cooling down from water dump five bakeout, a sudden temperature drop of approximately 25 °F was noted. This sudden decrease was indicative of a slug of water passing through the nozzle, probably resulting from an intermittent leak in the supply water dump valve. A review of data from previous water dumps during the flight showed a similar occurrence after supply water dump four.

The crew purged the supply water dump line and valve using the free fluid disposal in-flight maintenance procedure, and closed the isolation valve and dump valve for the remainder of the mission. Excess supply water was managed through the flash evaporator system for the remainder of the mission. After the mission, KSC performed an overpressure test on the dump valve and no leakage was indicated. This verified that no ice build-up had ruptured any of the supply water plumbing. The supply dump line, valve, and nozzle were then removed and replaced to troubleshoot both this anomaly and the supply water dump nozzle temperature drop anomaly seen on STS-39 (anomaly STS-39-V-08). **CONCLUSION:** The cause of the supply water dump valve intermittent leakage is presently unknown. The removed unit will undergo testing in a JSC vacuum chamber in an attempt to recreate the phenomenon. **CORRECTIVE_ACTION:** The OV-103 supply water dump line, valve, and nozzle have been removed and replaced. The removed unit will undergo testing and failure analysis at JSC. The replaced unit will be verified per OMRSD retest requirements prior to the next flight. Even if this phenomenon recurs, redundant methods of managing supply water are available. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 002:11:04	Problem	FIAR	IFA STS-48-V-05
MMACS-02	GMT: 258:10:16		SPR 48RF05	UA
			IPR 42V-0007	PR
				Manager:
				Engineer:

Title: Hydraulic System 2 Unloader Valve Leakage (ORB)

Summary: DISCUSSION: During checkout for STS-48, the hydraulic system 2 unloader valve (serial no. 007, a new dash 2 type) failed its scheduled decay check (high

ball leakage = 38.26 psi/hr; low ball leakage = 149 psi/hr; test requirements are no greater than 48 psi/hr for high ball and no greater than 32 psi/hr low). The valve was replaced with serial no. 024 unloader valve (also a new dash 2 type). The replacement valve failed to initially recharge the system 2 bootstrap system during its line replaceable unit (LRU) retest, but subsequently successfully recharged the system, although at a lower-than-specified pressure of 2250 (+0/-150) psia. The valve was then removed and replaced with serial no. 003, an older dash 1 type. This third valve successfully passed all leak, functional, and decay checks.

After ascent, accumulator 2 decayed from a lockup pressure of 2760 psia down to 2210 psia by day 3. At 258:10:09 G.m.t., circulation pump 2 was activated by software for thermal circulation. This also initiated an accumulator recharge through the unloader valve to a value of only 2305 psia. Recharge should have been to 2400 psia minimum. After the recharge, the subsequent accumulator decay was measured to be 369 psi/hr for the first 15 minutes, but leveled off when the accumulator pressure dropped to 2209 psia. Since a sudden change in decay rate was seen, it was assumed that the different leakage rates were associated with the two balls of the unloader valve pilot area. (Priority valve or accumulator leakage would not have manifested themselves in a sudden change in decay slope.) Unloader valve leakage has been seen many times before and is believed to be due to either accumulator-generated or unloader valve built-in contamination affecting proper reseating of one or both of the sealing balls of the pilot area. It is believed that the first high leakage decay noted was high ball leakage, almost an order of magnitude greater than the 48 psi/hr high ball specification. Since the low ball appeared to be holding, as indicated by the leveling out in pressure, no immediate action was taken, except to continue to monitor the system. Two additional thermal circulation pump runs produced progressively lower decay rate indicating a possible clearing of the contamination and reduction of the leak rate. However, when the circulation pump was deactivated after closing the landing gear isolation valve prior to FCS checkout, a leak rate of 2138 psi/hr was observed during a 2 minute 40 second interval. Auxiliary power unit (APU) 2 was used for FCS checkout to determine if that would assist in clearing the contamination and reducing the leak rate. Post flight control system (FCS) checkout to entry data indicated a significant reduction in the bootstrap pressure (unloader valve) decay rate.

CONCLUSION: Unloader valve leakage has been seen many times before and is believed to be due to accumulator-generated or unloader valve built-in contamination which affects reseating of one or both of the sealing balls of the pilot area. CORRECTIVE_ACTION: KSC has retested the unloader valve system per OMI V1010 during normal turnaround operations. The unloader valve failed the leakage specification and is being replaced. Improvements to the hydraulic bootstrap system which includes the unloader valve, to minimize susceptibility to contamination are currently being addressed on MCR 16598. MCR 16598 has been approved; however, funding is still pending. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 005:07:38	Problem	FIAR	IFA STS-48-V-06
PROP-01	GMT: 261:06:50		SPR None	UA
			IPR 42V-0005	PR
				Manager:
				Engineer:

Title: FRCS Manifold Valve 2 Phase C Down (ORB)

Summary: DISCUSSION: During entry and postlanding, the forward reaction control subsystem (FRCS) oxidizer and fuel manifold 2 isolation valves operated only on ac 2 phases A and B. Data included no phase C current increase when the manifold valves were closed following the FRCS propellant dump or when open postlanding. However, performance of the valves was nominal since the loss of a single phase does not significantly affect motor startup or operation.

Power to the FRCS ac motor valves is controlled at panel MA73C. The manifold 2 isolation valves are powered by the ac 2 bus and the phase C circuit breaker (cb) is designated cb34 on panel MA73C. Postlanding, it was verified that cb34 was engaged. Since contamination of cb34 was considered to be the most likely cause of the problem, troubleshooting intentions were to not touch cb34 until after the Orbiter was ferried to KSC. However, cb34 was cycled by the ground crew prior to ferry. The valves were operated upon return to KSC, and the flight problem could not be repeated. Troubleshooting, which included additional cycling of the cb and valves, did not repeat the in-flight problem. It is now believed that contamination could have been cleared from the cb when it was cycled on the ground prior to ferry. **CONCLUSION:** Troubleshooting was unable to repeat the problem seen during flight. The most likely cause of the problem was cb contamination. Previous experience has shown that in a low-current circuit, contamination can break continuity. It is an accepted procedure to cycle circuit breakers when contamination is suspected. **CORRECTIVE_ACTION:** None. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None. If the problem recurs, the FRCS manifold valves can function on 2 of 3 phases. Should a manifold valve fail closed, redundancy exists in the RCS to allow continued operations through other manifolds. Should one fail open, tank isolation valves can be closed to prevent propellant loss in the event of a leak.

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MER - 0	MET:	Problem	FIAR B-FCE-029-F039 IFA STS-48-V-07	GFE
INCO-01	GMT:		SPR IPR	UA PR
				Manager: Engineer:

Title: Closed Circuit Television (CCTV) Camera D Line Across Screen (GFE)

Summary: DISCUSSION: At 257:23:16 G.m.t., the camera D video exhibited a horizontal line just above the center of the picture and it remained there for the mission duration. The camera remained usable.

CONCLUSION: The line was most likely caused by degradation within the high voltage section of the camera. This problem is similar to a problem experienced on STS-32 with the C camera. The repair at that time included replacing the silicon intensifier tube image sensor. **CORRECTIVE_ACTION:** The problem could not be duplicated in postflight troubleshooting at the Flight Equipment Packing Facility. Indications are that the problem could be thermal and/or vacuum related. Troubleshooting will be continued by the vendor. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET:	Problem	FIAR BFCE-023-F009 IFA STS-48-V-08	GFE
None	GMT:		SPR IPR	Manager: Engineer:
			UA PR FCS-3-14-0439	

Title: Leak at Galley Valve MV-2 (GFE) (GFE)

Summary: DISCUSSION: During the postflight debriefing, the crew stated that approximately four ounces of water was observed around the galley MV-2 valve during the presleep activities on flight day 5. The water was wiped up with towels. During postflight on flight day 6 another four ounces of free water was observed at MV-2 and wiped up.

After the flight, a leak check was performed on the galley at twice its flight pressure for 45 minutes. No recurrence of the leakage around MV-2 was noted.

CONCLUSION: The cause of the water leakage around galley valve MV-2 is unknown. CORRECTIVE_ACTION: The fittings for galley valve MV-2 were retorqued.

Should a similar leak recur, it poses no impact to galley operations (criticality 3) and the water can be easily cleaned up. EFFECTS_ON_SUBSEQUENT_MISSIONS:

None.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET:	Problem	FIAR IFA STS-48-V-09	GN&C,FCS
None	GMT:		SPR None IPR None	Manager: Engineer:
			UA PR	

Title: Extraneous Body Flap Motion (ORB)

Summary: DISCUSSION: At Mach 23, an oscillation was observed in the body flap that lasted about 1 minute. The oscillation consisted of three distinct regions of square wave type motion with a peak-to-peak amplitude of 1.7 degrees and a period of 4 seconds. Due to the longitudinal trim change caused by the body flap motion, the elevons responded with a corresponding oscillation to keep the vehicle properly trimmed. The elevon oscillation had an average peak-to-peak amplitude of 1 degree.

CONCLUSION: The body flap motion that was seen in-flight exhibited the same characteristics that the smart body flap utilizing "case 2" I-loads is capable of generating.

The I-loads for the smart body flap were changed to the "case 2" values for STS-43 and subsequent flights to alleviate the thermal load on the SSME bells. This I-load change resulted in decreased stability margins in the body flap channel; however, the stability margins still meet the design requirements. Simulations and off-line stability analysis tools showed that some extraneous cycling of the body flap was possible depending on the X-center-of-gravity (c.g.) range being flown.

CORRECTIVE_ACTION: Although this is not a safety of flight issue, this motion is not highly desirable. The body flap models will be reassessed and possible changes to the I-loads are being investigated. EFFECTS_ON_SUBSEQUENT_MISSIONS: This body flap motion cannot be absolutely predicted, but it is c.g. dependent. Only c.g.'s aft of approximately 1093 inches have the potential of producing this motion. Should, for unforeseen reasons, the oscillations become excessive in-flight, the body flap would be taken to manual control.
